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FORAGE CROPS FOR THE COTTON REGION.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., May 15, 1912.

SIR: I have the honor to transmit and to recommend for publication as a Farmers' Bulletin the accompanying manuscript on "Forage Crops for the Cotton Region," prepared by Prof. S. M. Tracy, Special Agent, Office of Forage-Crop Investigations.

This manuscript treats of the most important forage crops that are adapted to the various sections of the cotton region and is designed to replace Farmers' Bulletin No. 300, entitled "Some Important Grasses and Forage Plants for the Gulf Coast Region," which is much less comprehensive.

Owing to the large variety of forage crops adapted to the area discussed, doubt frequently exists as to which should be given preference. The appended digest of the opinions of the directors of the State experiment stations in the region will be helpful, especially as there is so little divergence in their conclusions.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

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FORAGE CROPS FOR THE COTTON REGION.

INTRODUCTION.

The soil and climatic conditions of the cotton-growing region are in the main so different from those in other parts of the country that different crops, and to some extent different methods of management, are necessary to secure the most profitable forage for grazing, soiling, and making hay. In this region the velvet bean, beggarweed, Mexican clover, Japan clover, Bermuda grass, and a number of other forage plants which can not be grown elsewhere, give highly profitable returns, while the common forage crops of more northern regions—timothy, red clover, bluegrass, and others—have little value. During the last 12 years much progress has been made in determining the most valuable of the numerous forage crops adapted to the cotton-growing region, in the introduction of new varieties for cultivation, and in the management of both meadows and pastures.

The climate in this region is so warm that growth continues nearly or quite throughout the year, so that it is possible to grow a great variety of forage crops, some of which will be suited to every season. The rainfall ranges from about 60 inches near the Gulf coast to about 40 inches at its northern limits and induces rapid growth, making it possible to grow a profitable crop of hay during any 10 weeks of warm weather. The period of eight or nine months without frost makes it possible to secure three cuttings of hay from permanent meadows, besides giving a very long season for pasturing.

SOILS.

The selection of the best forage crops for any given region depends to some extent upon the character of the soil on which they are to be grown. Depending partly on soil and partly on climate, the Southern States may be divided into six regions, at least so far as forage crops are concerned.

(1) The sandy-soil region extends along the Atlantic coast westward through the southern part of the cotton region to eastern Texas and is broken by numerous alluvial valleys along the rivers. These

soils belong to the Norfolk series. In general, the surface soil is a light, easily worked sandy loam, which northward is underlain with clay, but becomes more sandy toward the south, until it merges into the still more sandy coast region. In the main, the soils become heavier sandy loams the greater the distance from the coast. Most of these sandy soils are poor in lime and respond quickly to its application.

(2) The upland clay hill region is an irregular belt northward from the sandy soils, reaching from the Carolinas westward to northern Louisiana and more or less interrupted by the river valleys and the black prairies. The soils belong mainly to the Orangeburg series and are usually very compact and often deficient in humus. They lack cohesiveness and are likely to suffer from washing when improperly handled or left bare through the winter, but they are very productive when intelligently managed.

(3) The alluvial soils belong mainly to the Wabash and Trinity series and cover thousands of square miles along the Mississippi, Red, Pearl, and other large rivers, while small areas are found along nearly all of the streams. These soils are always very fertile, and along the larger streams are usually rich in lime, though this element is sometimes deficient in alluvial soils along the smaller streams which have their origin in the upland clay or sandy pine regions.

(4) The black prairie regions lie principally in northwestern Alabama and northeastern Mississippi and are very similar in character to the "black-wax" soils of Texas. These soils all belong to the Houston series. They possess an abundance of lime and are exceedingly productive but require careful handling. As a rule the natural drainage is poor, and if plowed while wet an artificial hardpan, or plow sole, is soon formed, especially if the land is always plowed to the same depth. When this plow sole is formed, both cotton and grain crops are likely to suffer severely from insufficient drainage in wet weather and from drought in dry weather. By deep plowing, this hardpan may be destroyed, but it is better practice to plow the land at varying depths in different seasons so as to avoid its formation. To some extent plants like alfalfa with strong taproots will penetrate and break up the hardpan.

(5) The treeless prairie region occurs in southern Louisiana and southeastern Texas. The black soils of this region belong to the Crowley series and are very fertile, but owing to the level nature of the land they often suffer from lack of drainage. Rice, corn, and sugar cane are the principal crops, though cotton yields heavily when not injured by the boll weevil.

(6) Florida and the immediate Gulf coast region westward to Texas are characterized not so much by soil as by a subtropical

climate permitting the growing of many forage crops which do not succeed well farther north. In the main the soils are light and sandy, and usually poor in lime.

GRASSES.

Few of the grasses most grown in the Northern States are useful in the cotton region, as they do not thrive during the long period of warm weather. No one hay grass in the South possesses an importance corresponding to timothy in the North, and it is hardly likely that any such will ever be discovered. On this account, success in hay growing requires a knowledge of the relative value and methods of culture of the various grasses that are adapted to Southern conditions.

BERMUDA GRASS.

Bermuda grass is the foundation of all the best permanent pastures in the South, and in many localities is important for hay. It endures severe drought without much injury, makes excellent grazing from late spring until heavy frost, and yields a fine quality of hay. It requires a rich and fairly moist soil for its best growth, being dwarf and spreading in habit when on hard clay or light sandy soils, but becoming more erect and dense as the fertility of the soil is increased. It is one of the best grasses for creek and river bottom lands, for binding levees and ditch banks, and for lawns which have good care. It is propagated by either seed or roots. When seed is used the ground should be well prepared with a fine, smooth surface, as the seeds are small. The seeds should be mixed with cottonseed meal or fine soil to increase the bulk, so that they will be distributed more evenly. They should be sown in March or April at the rate of 5 pounds per acre and may be covered by using a roller or a light smoothing harrow. As the seed is expensive and somewhat uncertain in germination, Bermuda grass is usually propagated by planting small pieces of the sod.

When a field is to be used as a meadow it should be well prepared and pieces of sod set 2 to 3 feet apart. This may be done at any time from March until August. Very little care is necessary in planting. The common method is to cut thin sods from an old field and tear them into small pieces. These are dropped at the proper distances and forced into the ground with a forked stick such as is used in planting sweet-potato draws. When planted for pasture it is not so necessary to have the surface of the ground smooth. A common method of planting is to run furrows 3 or 4 feet apart, drop pieces of sod at intervals of 2 or 3 feet, and cover with the foot. The grass will seldom do much more than cover the ground the first season, but when a good sod is once formed it will last indefinitely. The

yield of hay on rich bottoms may be as much as 4 tons per acre, less on poorer soils, and on dry clay hills not worth harvesting. The feeding value of the hay is about equal to that of timothy.

The planting of this grass is objected to by some on account of the difficulty of eradicating it when the field is wanted for other uses. With proper management, however, this is usually not a serious matter. It is difficult to kill it with even the most persistent cultivation, but it is easily destroyed by any dense smothering crop which keeps it heavily shaded. Plowing the ground in late summer, sowing winter oats and vetches, and following that with a summer crop of cowpeas or velvet beans will kill nearly all of the grass. This method will furnish two profitable crops, besides putting the soil in fine condition for any succeeding crop.

CARPET GRASS.

Carpet grass is to the light and sandy soils what Bermuda is to the heavier and richer soils. It reaches its greatest perfection on the light soils near the Gulf coast, where it "comes in" very quickly when the land is pastured or heavily trampled; and it is more or less common as far north as central Georgia and northern Louisiana. Its creeping habit of growth enables it to bear close grazing without injury. It is strictly a pasture grass, seldom growing large enough to be worth cutting for hay. It will stand close grazing and heavy trampling better than any other grass in the Gulf region; in fact a considerable amount of trampling seems necessary to its best growth, as it disappears when stock are taken from the field or the land is put into cultivation.

The usual method of propagation is to cut some of the grass which has been allowed to mature seed and to scatter the hay over the pasture in which it is wanted. Little seed is produced where the grass is grazed closely, but when stock is taken from a field in July or August an abundant supply can be secured in September or October. It grows readily when scattered on the surface of the ground, and comparatively little seed is needed. When even a few patches become established in a pasture it soon spreads over the entire field, and on a field which is well trampled it will make a good sod in about two years even where the ground has never been plowed. A quicker and surer method of propagation is by transplanting pieces of old sod as Bermuda is propagated, but this is much more laborious and expensive.

Although it makes little growth after the first heavy frosts in the fall it furnishes good winter grazing if stock have been removed from the field in July or August, for it will make a growth of 6 to 12 inches by November, and the lower stems and leaves which are pro-

tected from frost will remain green and give fresh grazing through the winter, but pastures which have been grazed closely all summer give little winter feed. Like Bermuda grass it needs sunshine for its best growth, though it makes considerable good feed in wooded pastures and brush land.

JOHNSON GRASS.

Johnson grass makes a heavy yield of excellent hay and gives good grazing for one or two seasons, but is such a pest when growing in fields where it is not wanted that its planting in clean fields can not be recommended. It makes its best growth on heavy soils, especially on the black prairie lands, on clay lands which are rich in lime, and on the black-wax lands of Texas. On light sandy soils its growth is weak and it is short lived. On soils suited to its growth it yields very heavily for two or three years, after which the thick heavy rootstocks become so matted in the surface soil that the yield is greatly reduced. If such land is to be kept as a meadow it should be plowed and harrowed about once in three years, after which it will yield as heavily as ever. The hay made from it is of excellent quality if cut before the seeds are formed, but becomes coarse and tough as the plants mature. It does not bear grazing well, as the fleshy rootstocks then make only a weak growth and the growth of stems and leaves becomes very small.

Grazing does not kill the grass, however, for when an old pasture which was originally well set with it is plowed up the grass soon becomes vigorous again. It is quite possible to eradicate it without excessive labor or expense. When there is only an occasional small patch in the field it can be killed by hoeing thoroughly and then covering the surface of the ground with half an inch of common salt. When a large area is to be cleared it can be done by taking advantage of the fact that the rootstocks from which the new shoots are produced live only one year and that they are formed near the surface of the ground which has not been plowed recently. If the land is not plowed for a year the young rootstocks will all be found within 2 or 3 inches of the surface. By plowing shallow late in the fall when the weather is dry and following that by a thorough harrowing with a spring-toothed harrow which will drag the roots out of the ground, nearly all will be killed during the winter. By repeating this work in the spring and planting the ground in some hoed crop like cotton or corn the few sprouts which may appear are easily killed. The only expense is for the extra plowing and harrowing and that is more than repaid by the additional crop which will be made as a result of the thorough working of the ground.¹

¹ Cates, J. S., and Spillman, W. J. A Method of Eradicating Johnson Grass. Farmers' Bulletin 279, U. S. Dept. of Agriculture.

PASPALUM DILATATUM.

The grass known as *Paspalum dilatatum*, and also as paspalum, large water grass, and smooth paspalum, came originally from Argentina and has become thoroughly established in all the cotton region where the soil is fairly heavy and somewhat moist. In late years it has been much exploited in Australia. It does not thrive well on very dry or very sandy soils, but is most abundant on the creek bottoms and lowlands from South Carolina westward to Louisiana. It is a perennial which makes a continuous growth during warm weather, is not injured by close grazing or by moderate frosts, and so has great value as a pasture plant for both summer and winter. When the plants are scattering it is inclined to grow in rather large clumps and therefore is better for grazing, but when it occupies the ground fully the clumps are small and the growth nearly erect. It seems to make its best growth in central and northern Georgia, and in that section it is sometimes cut for hay. The land on which it is grown may be mowed twice during a season, the first cutting made in May being principally of vetches and mixed grasses, and the second and better cutting, in midsummer, when the yield may be as much as 2 tons per acre. The hay is of excellent quality and sells readily on the local market.

Paspalum is rather difficult to propagate, as it does not spread by runners and a large part of the seeds fail to mature in good condition. The best seeds are usually those which ripen late in the season, and during October and November a limited supply may be obtained from the scattering plants which are found on nearly every farm. Those who cut the grass for hay often secure seed from the refuse in the bottom of the mow, though much of the seed collected in this way fails to grow. Fortunately, the grass is very hardy, and when a few plants have become established in a field it will spread slowly over the richer part of the ground. It never becomes a weed and is rarely seen on cultivated ground. American seed is not often found on the market, and much which is sold under that name is seed of purple water grass, or purple paspalum, an annual and almost worthless species. Australian seed is expensive and not high in germination. This grass is one of the best winter grazing grasses in the South, and it is well worth while to establish it on every farm south of Tennessee and North Carolina. The seed may be sown broadcast at any time during the late fall or winter, after which the ground should be disked or harrowed, though a fair stand is often secured by scattering the seed over the field and giving it no further attention.

PARA GRASS.

Para grass, which is probably native to South America, is now common in some parts of Florida and is rapidly coming into favor

farther west, especially in southern Texas. It is adapted only to Florida and the Gulf coast, though it survives the winters as far north as Charleston, S. C. It is a rank-growing perennial, spreading by runners, often 30 or more feet in length, which form roots at each joint that touches the ground. As soon as the ground becomes fairly well covered with these runners, erect or ascending branches are produced, reaching a height of 2 to 3 feet or more and producing a heavy yield for either hay or grazing. Although Para grass spreads so rapidly by its long runners it is more easily killed than Bermuda or Johnson grass, as the runners are wholly above the surface of the ground and can be destroyed by a single shallow plowing late in the fall followed by a thorough harrowing. In regions where heavy frosts occur it is killed by plowing alone if the work is done at the beginning of the cold weather. While it makes a fair growth on moderately dry soil it does much better where the ground is wet and on the margins of ponds often reaches to where the water is 3 or 4 feet deep. It is a desirable species for planting on lands liable to overflows, as it is not injured when covered by water for a month or more.

Para grass produces little good seed and is usually propagated by divisions of the runners. These root easily if cut into pieces of two or three joints each and pushed into freshly plowed ground so as to leave the upper joint just at or a little below the surface. When sets are abundant it is better to put them about 2 feet apart. Planting may be done at any time from early spring until about three months before frost is expected. It makes a rather coarse hay, but is sweet, tender, and nutritious, and the yield is very heavy. One Texas grower reports 4 tons per acre from each of two cuttings on a 12-acre irrigated field and that a third crop, equally heavy, was grown but was not cut on account of an early frost. Florida growers make three to four cuttings annually, and the hay finds a ready market at a high price. It is also an excellent pasture grass when not grazed too closely. One field of 10 acres in southern Texas gave grazing for 15 cows from May to November, and at the close of the season the grass was fully 2 feet tall and appeared to be growing faster than it was eaten, though the field had not been irrigated during the preceding 18 months. A grower in southern Mississippi reports equally good results from a planting made on low rich land and very poor results when planted on dry clay. A field which is well set with the grass may be kept in good condition almost indefinitely if it is given a shallow plowing in the spring and then seeded with cowpeas. The grass will then make a vigorous growth and the first cutting will be ready when the peas begin to mature, the mixture making a hay of choice quality and a better yield than when the grass is grown alone. The pea vines will make no further growth, but

the grass will make two to four later cuttings, each heavier than if the ground had not been plowed.

Some of the Florida orange growers who have it thoroughly established in their groves complain that Para grass makes cultivation difficult, and that it is seldom advisable to allow it to gain a foothold on land which is to be cultivated. In Cuba and in the extreme southern part of Florida, where the rainfall is heavy and frosts are rare, it may be a dangerous weed, but it is easily killed in any region where moderate frosts occur and in irrigated regions by withholding the water a short time. It is killed to the ground by heavy frosts and is not recommended for planting where the temperature falls below about 18° F.

GUINEA GRASS.

Guinea grass, a native of Africa, is now a common grazing grass in Cuba and other West Indian islands, whence it was introduced into Florida as early as 1870. Though very different in appearance and habit of growth it has often been confused with Johnson grass, which has been called by the same name. Johnson grass spreads by long fleshy underground rootstocks and has seeds which are of a red, yellow, or nearly black color, while Guinea grass grows in dense erect clumps, does not spread by rootstocks, and has seeds which are dark green in color. The leaves of Guinea grass are never streaked with red or yellow, as those of Johnson grass often are. Anyone who notes any of these characters will never mistake one grass for the other.

Guinea grass grows to a height of 6 to 12 feet and is used principally for grazing and soiling. Its range of profitable cultivation is about the same as that for Para grass, including the whole of Florida and a narrow strip westward along the coast south of latitude 31°. It has been grown successfully near Mobile for some years and matures an abundance of seed both there and in southern Mississippi. It is very promising in the few localities where it has been tried in southern Texas. It does well on moderately dry soil and can never become a pest like Johnson grass. It is propagated by divisions of the roots or by seeds. When roots are used the old clumps should be dug out early in March and divided, a single stem with a few good roots being sufficient for a set. If planted about 3 feet apart in rows 6 feet wide, the young plants will give a good cutting or be ready for grazing in May. Seeds are planted at the same season as the roots, the usual practice being to plant them in drills and then to transplant the seedlings when they are 3 or 4 inches high. Volunteer seedlings are often found in abundance where the old plants have been allowed to mature seed. Sets are more expensive and troublesome

than seedlings but will give an earlier and heavier yield the first season.

When the crop is to be used for soiling and heavy yields are expected the ground should be occasionally cultivated and a dressing of cottonseed meal given just before each cultivation. The grass begins its growth rather late in the spring, seldom giving much feed before May, but after that time it will give good cuttings once every three or four weeks until its growth is stopped by frost. In the most favorable part of the season cuttings may be made every 10 or 12 days, though such a rapid growth is maintained for only a few weeks. It makes the best feed if cut when 18 to 24 inches high. If allowed to stand too long the stems become hard and woody. It is difficult even to estimate the yield per acre, as it is used principally for grazing and soiling, its habit of growing in large clumps making it hard to cut for hay. One grower who has used it many years for soiling reports that he can feed four head of cattle per acre through the entire season, while another who is growing cattle extensively reports that he grazes three head per acre through the entire year, but adds that he also gives a little Para grass hay in the winter. A grower in southern Florida says, "It is the best grazing grass we have"; and another says, "It yields more than any other grass." Similar statements are made by growers in southern Alabama and Mississippi. It does not bear frost well and is often killed by a temperature of 25° F.

RHODES-GRASS.

Rhodes-grass, a newly introduced species, is a native of central and southern Africa, where it is regarded as one of the best species for pastures on dry soils. It is a perennial, growing from 3 to 4 feet high, with a large number of very long, narrow, and tender leaves and with rather few branching stems.

When grown from seeds its growth is commonly erect the first season, but when grown from roots, or the second season when grown from seed, it makes runnerlike branches 2 to 4 feet long, which root at the joints and so cover the ground quite rapidly.

It is propagated by both seed and roots. When seed is used it should be sown at corn-planting time at the rate of about 10 pounds per acre on a soil having a fine mellow surface, and then given a light harrowing. As the seed is produced only in small quantities and as it continues to be developed and matured through the entire season, little of it can be gathered at any one time; consequently the grass is more commonly propagated by roots. The roots may be planted on well-prepared land at any time from February to July, putting them 2 to 4 feet apart and protecting them from grazing until they become well established. This grass has been introduced so recently that seed is still scarce in the market.

While the principal value of the grass is for grazing it is also used for hay, giving two or three cuttings of about 1 ton each per acre. The hay is of excellent quality. It bears severe drought and moderate frost without injury, but is easily killed by plowing late in the season. It is not recommended for cultivation except in the southern part of the Gulf States. Rhodes-grass is especially promising for the semiarid regions of the extreme Southwest, where the temperature does not fall below 20° F.

NATAL GRASS.

Natal grass, from South Africa, is much like crab-grass in habit of growth, but where the soil is very sandy it makes a heavier yield of better hay. It has become thoroughly established in parts of Florida and is gradually spreading over the sandy coast lands to the westward. The roots are killed by heavy frosts, but from central Florida southward it becomes perennial and is used occasionally for permanent meadows. Farther north it is an annual, making a volunteer growth in fields from which early crops have been gathered and often producing a heavy growth in cornfields after cultivation ceases.

CRAB-GRASS.

Crab-grass is of considerable importance as a volunteer hay crop, especially on sandy soils. It makes its growth late in the season on lands from which early crops like oats, melons, or potatoes have been taken and often makes a good growth in fields of cowpeas, where it adds largely to the yield of hay. The crop should be cut early, soon after the first seeds begin to mature. It is somewhat difficult to cure, but when well handled at the proper stage of growth it makes a hay of good quality. It is always a volunteer crop and need never be sown.

ORCHARD GRASS.

While orchard grass seldom makes a heavy yield of hay in the cotton region it is an excellent pasture grass on wet and heavy soils. It is a perennial which begins its growth very early in spring and is ready to cut in April. It furnishes good grazing until its growth is checked by the summer drought. With the first autumn rains it starts a new growth of leaves, making rich fall pasturage and remaining fresh and green through the winter when the cold is not too severe. The hay made from it is of excellent quality, though its habit of growing in large clumps is against its use as a hay grass. It bears grazing well and recovers quickly when cropped down. It does well when mixed with redtop and succeeds better than almost any other grass in woodland pastures. Sandy soils are not suited to its growth, and it can not be recommended for any light thin lands.

Seed should be sown in August or September, or very early in the spring, at the rate of 20 to 30 pounds per acre.

RYE-GRASS.

Two species of rye-grass, Italian (*Lolium multiflorum*) and perennial (*Lolium perenne*), are commonly cultivated. The former, while not truly an annual, is agriculturally treated as such. It makes a more rapid and usually a larger growth than the latter. Both are quickly injured by excessive heat or drought and so are not suited for permanent meadows or pastures, but as they make a quick and vigorous growth soon after planting they are valuable where immediate results are wanted. They are especially desirable for sowing with newly planted Bermuda, redtop, and other slow-starting grasses. If sown in the fall they will give rich late-winter and spring grazing, or they may be cut for hay in April or May, after which they soon disappear. It is important that the crop be cut as soon as well grown. If that is not done the warm rains of June and July will cause the leaves to decay very rapidly and smother the small plants of other grasses which may be growing on the same ground. On rich alluvial land these grasses often persist two or three years when used for hay, but seldom last more than one year when grazed. They are among the best of grasses for planting on newly made lawns, as they soon cover the ground and give it an attractive appearance, while the Bermuda and other slower starting sorts are becoming established. Seed should be sown in October or February at the rate of 20 to 30 pounds per acre when sown alone or half that amount when sown with other grasses. Italian rye-grass is becoming more and more used for fall planting on the sandy coast lands. It makes a much better winter pasturage or hay than rye.

REDTOP, OR HERD'S-GRASS.

While redtop is seldom used alone for either hay or grazing it is an important factor in both meadows and pastures. It is slender in growth, and the yield is not large, though the hay is of good quality. It makes its best growth on soils too poorly drained for most other crops and therefore is important on all wet lands. Redtop is a perennial which bears frost well and so gives winter grazing. It does better on wet clay soils than on those which are sandy and has little value for dry uplands. It is one of the best kinds for creek banks, the margins of swamps, overflowed lands, and similar places where Bermuda grass, bluegrass, and other upland kinds can not be grown. On the rice lands of South Carolina it succeeds better than any other grass. Seed may be sown in either fall or spring at the rate of 6 to 10 pounds of cleaned seed per acre. The growth is usually weak the first year, but it gains vigor with age and holds the ground well

against other grasses. While redtop will make a fair growth on land which has not been plowed, it pays to prepare the ground well when large fields are to be sown. If from 4 to 6 pounds of the redtop seed are mixed with 30 to 40 pounds of Italian rye-grass, a good crop of the mixture will be secured the first season, after which the rye-grass will gradually disappear and the redtop will occupy the ground.

KENTUCKY BLUEGRASS.

The northern limit of the cotton region is nearly the same as the southern limit of the bluegrass country, though Kentucky bluegrass does well in some places from North Carolina westward to Arkansas, especially in the valleys of the limestone country. It is seldom used for hay, as its growth is too short and the yield too light, but where it can be grown it makes excellent pastures. It succeeds best on a rich lime soil which is clayey rather than sandy and is well drained without being too dry. It makes its best growth in fall and spring and remains green through the winter, but suffers severely in long-continued hot weather and so is not suited for use in the extreme South.

RESCUE GRASS, SCHRADER'S GRASS, OR AUSTRALIAN OATS.

Rescue grass, Schrader's grass, or Australian oats, is sometimes highly valuable and at other times disappointing. When planted on a very rich loamy soil and the season is favorable it makes a heavy winter growth, which affords fine grazing from December to April or a heavy yield of hay in early spring and often a second cutting later. If the conditions are not favorable it may not begin its growth until late winter, only a poor stand will usually be secured, and its growth will be weak and unsatisfactory. It disappears on the approach of hot weather, but a few of the plants will live through the summer and with the scattered seed will often make a good volunteer growth the following season. Its growth and behavior are so uncertain that it is a reliable hay plant in only a few localities, but its winter growth makes it a desirable addition to pastures, especially for mixing with orchard grass, bur clover, and vetches. It makes its best growth only on freshly plowed land and seldom persists many years where other grasses are allowed to form a sod. Seed should be sown in August or September at the rate of 30 to 40 pounds per acre.

TIMOTHY.

Timothy has little value in the cotton region except in the extreme northern section, as it makes almost no second growth after being cut, the bulbs at the base of the stem being injured or killed by exposure to the hot sun through the long summer. If sown in the fall

or in early spring it will give one profitable cutting and then almost wholly disappear. A few alfalfa growers practice sowing timothy with the alfalfa seed in September, as it does much to occupy the ground and prevent the growth of crab-grass, until the alfalfa is strong enough to protect itself besides giving one good cutting for hay in early spring. Italian rye-grass is, however, preferable for this purpose. Timothy can not be recommended for general cultivation in any part of the cotton region.

MILLETS.

The millets which are most valuable in the cotton region are those belonging to the foxtail group. Of these there are several varieties, the principal being the common, the Hungarian, and the German, which differ mainly in size and period of growth. Common millet was one of the first varieties to be cultivated in the United States and is one of the most hardy sorts, bearing severe drought with little injury and making a heavier yield than the others when grown on poor soils. The hay is also of finer quality, though when grown on rich soil it does not yield as heavily as the German. Hungarian millet does not bear drought as well as common millet, but under favorable conditions of soil and moisture it gives a somewhat better yield. German millet makes a much heavier yield than either of the others when grown on a moist rich soil, but is not as well adapted to dry uplands. The hay is coarser than that of the others and should never be allowed to become overripe.

All of these millets make their best growth during warm weather, and so are used largely as catch crops, to be sown in May or June on land from which oats or some other early crop has been gathered or on land which is wanted for planting in September or October. They are shallow-rooting plants, and therefore the upper 2 or 3 inches of soil should be made as fine and mellow as possible before seeding. When a previous crop has just been removed a thorough disking is usually all that is needed, after which the ground should be harrowed smooth and the seed sown at the rate of 2 to 3 pecks per acre and covered by rolling or by light harrowing. Rich heavy soils require less seed than those which are thin and light. It is important that all of the varieties be cut early, as when overripe the hay is very harsh and woody, is not easily digested, and often has a decidedly laxative effect when fed to horses or mules. A common practice is to cut as soon as the grass is well headed, which will be in 40 to 50 days from sowing for the Hungarian, 50 to 60 days for the common, and 60 to 70 days for the German. If the weather or other conditions are such that it can not be cut until the seed is well developed, it will usually be better to let it stand a week or 10 days longer and then save it for seed, which as a rule brings a good price.

A seed crop should be cut, bound, and thrashed like wheat, the thrashing leaving the straw so broken and splintered that it is in fair condition for feeding. Many feeders object to using millet hay exclusively as feed for horses on account of its effects on the kidneys, but one daily feed of millet and one of some other kind of hay make an excellent combination.

COLORADO GRASS, OR TEXAS MILLET.

Colorado grass, or Texas millet (*Panicum texanum*), is valued highly for a late hay crop on the river bottom lands of southern Louisiana and Texas, where it is native. It is an annual, growing from 2 to 4 feet tall, very leafy, and better for hay than for grazing. It prefers rich alluvial soils, where it volunteers as does crab-grass, but it does not grow well on dry uplands. Like crab-grass, it should be cut early, before the seeds have matured, when it makes excellent hay. If left until fully ripe, the stems become too hard and woody, and a large part of the seed is lost. It has not succeeded well on the Atlantic coast or in the northern parts of the Gulf States, but seems especially adapted for use on the river bottom lands of southern Texas. Seed may be sown at any time during the early summer at the rate of 40 pounds per acre, and when one crop has been grown the land will not need reseeding.

CEREAL GRASSES.

Wheat, oats, rye, barley, and to some extent rice are used both for winter pastures and for hay. All except rice are usually sown in the fall, as they then give good grazing through the latter part of the winter. If the stock are taken off just before the stems begin to shoot, a fair crop of hay can be made by cutting the wheat when it is in the milk stage and the oats when a little riper. Spring-sown oats also make fine hay, but do not usually yield as well as those sown in the fall. If wanted especially for grazing, the varieties known as Myers Turf and Gray Virginia are excellent, while the Texas Rust-proof is more popular for hay. Rye and barley make poor hay, but are excellent for winter and spring grazing. For most winter grain crops about $1\frac{1}{2}$ bushels of seed are used per acre; for oats the quantity of seed is usually a fourth or a half greater. In many parts of the rice districts good hay is made from the fields which have been cut for the grain. Such fields usually make a considerable second growth and may even head well, but seldom mature good seed. The land on which such hay is made must not be flooded while the second growth is coming on, or the leaves will become covered with sand and mud and make the hay dangerous for feeding.

SWEET SORGHUM.

Probably more acres of sweet sorghum than of any other crop are grown for soiling, and it is used largely for hay. It can be used from May to January and makes a very good quality of rather coarse hay. When wanted for hay it is sown very thickly to prevent a too coarse growth and then cut as soon as the heads appear. When planted early two cuttings may be made in the northern part of the cotton region, while in southern Texas four or five cuttings are sometimes made from a single planting. The yield of hay is often very heavy, the amount depending largely on the richness of the soil and the length of the growing season. A grower in the Rio Grande region of southern Texas reports a yield of 10 tons of dry hay per acre from the first cutting, about half that amount from the second cutting, 1 ton from a third cutting, and that the total yield of a little over 16 tons per acre found a ready sale in the local market. A South Carolina grower reports making 10 tons of hay per acre where the sorghum seed was sown at the rate of 3 bushels per acre and the crop grown in rotation with a winter crop of wheat and vetch. Such crops are very exhausting to the soil, and the roots decay so slowly that they often interfere seriously with the cultivation of the succeeding crop. Crops for soiling should be planted in rows 4 feet apart and cultivated at least once after each cutting. The last cutting made in the fall is sometimes windrowed like sugar cane and sometimes shocked and allowed to stand in the field until used, as it keeps in good condition two or three months when treated either way. When matured stalks are fed it pays to run them through a feed cutter or a shredder and if they have been in shocks for some time to wet them well before feeding. It is one of the best crops for grazing hogs, and cases of the poisoning of cattle when grazing on it late in the season in the South are extremely rare, occurring much less frequently than farther north. The varieties in most common use are the Amber for early and the Orange for a heavier yield and a succession of cuttings. The Sumac, or Redtop, variety is in most places much superior to the Orange. The Goose-neck is also a desirable variety.

JAPANESE SUGAR CANE.

In habit of growth the Japanese sugar cane is similar to the ordinary sugar cane of Louisiana, but the stalks are more slender and the stools larger; it also stands more frost and needs replanting less frequently. It is propagated by planting sections of the matured canes in the same manner that the Louisiana cane is propagated, and its cultivation is practically the same as that needed for corn. It may be planted in either fall or spring, fall planting being prefer-

able, as that gives it an earlier and better start in the spring. It is planted in rows about 6 feet apart, the rows being opened by running two furrows to throw out the earth and make a shallow trench in which the canes are laid lengthwise and covered by throwing the furrows back. When an abundance of canes can be had for planting it is better to lay two canes side by side the entire length of the row, breaking joints, and so securing a more even and perfect stand. When canes are scarce only a single line need be used. In some cases, where the canes are very large and the ground in fine condition, good success is obtained by cutting the canes into pieces of three or four joints each and planting them 2 feet apart.

On fairly rich soil it continues to make good yields for many years, though the soil must be frequently and heavily fertilized if a continuous high yield is to be maintained. On good soils it makes 40 to 60 tons of green feed per acre, and many growers prefer it to sorghum for cows and hogs. The leaves are killed by moderate frosts, but the stalks remain sweet unless actually frozen and can be kept in good condition through the winter by windrowing.

When the canes are to be windrowed they are stripped and topped as for grinding. They are then cut and the canes from four rows are laid lengthwise in the central space and covered with sufficient soil to protect them from freezing. Care should be taken that the windrowing is done before the canes are injured by frost and that the windrows are placed on ground so well drained that water can not stand about the buried canes. In northern Florida the canes are often left standing in the field until the new growth starts in the spring, being cut only as wanted for feeding. In addition to its use as a forage plant the Japanese sugar cane is often used for making sirup, a grower in central Mississippi reporting a yield of 750 gallons per acre, though the Louisiana cane is usually preferred for that purpose in localities where both can be grown. It is grown quite commonly in Florida and from central Georgia westward to central Mississippi, and its cultivation is extending westward through central Louisiana and Texas.

TEOSINTE.

Teosinte needs a long season of warm weather, a rich soil, and abundant moisture in order to succeed well, and it is useless to plant it where all those conditions can not be had. It is a remarkably vigorous grower, reaching 10 or 12 feet in height, with an unusually abundant supply of leaves and slender stems which continue to grow until killed by frost. It is planted and cultivated like corn, and if cut when it reaches 4 or 5 feet in height makes excellent fodder and will produce a second cutting fully as large as the first. If left to

grow until September or October it furnishes excellent material for the silo in greater quantity per acre than either corn or sweet sorghum. It is also one of the best plants for soiling purposes. The plants stool freely, sometimes as many as 50 stalks growing from a single seed; its leaves are similar to those of sweet sorghum, but much longer, and the stalks contain 8 to 10 per cent of sugar. Its growth is very rank, the Louisiana station reporting a yield of over 50 tons of green feed per acre on rich alluvial soil. Its season of growth is so long that it seldom matures seed north of latitude 30° N., but it has ripened well at the Florida and Louisiana experiment stations. The seed, 4 to 5 pounds per acre, should be planted in hills 4 to 5 feet apart each way at about the time cotton is planted. The greater distance should be given on the richer soils. On lands of only moderate fertility sweet sorghum is much to be preferred.

LEGUMES.

Leguminous plants, those belonging to the pea and clover family, should be grown in every permanent meadow and pasture, as they make a large increase in the total yield, their mixture with the grasses makes the feed of better quality, and their cultivation adds to the fertility of the soil. Many of them are annuals, and so can be used as catch crops. Some make their growth during the summer, others grow only during the winter, while still others are perennial and continue a vigorous growth for many years. Many of the annuals reseed the ground freely, and so are easily grown from year to year. Few of the perennial sorts bear grazing as well as some of the grasses, while some of the annual sorts are among the best of pasture plants. The hay made from the legumes is especially valuable for young and growing animals, for animals which are being fattened, and for those which are not doing hard work. For hard-working animals, like livery horses and farm teams during the planting and cultivating season, hay made from grasses, or a mixed hay, is preferable to one made wholly from legumes.

The legumes are not only valuable for hay and pastures, but they are also the best plants which can be used for green manuring, which is of the highest importance in the cotton region, where the supply of humus and consequently of nitrogen in the soil becomes exhausted rapidly with the clean cultivation given to cotton and corn and the constant warmth of the soil. In few other parts of the country is green manuring more necessary or more profitable than in the South, and the growing of legumes provides a large part of the fertilizer needed for other crops. On this account they should be included in every system of rotation, if possible.

ALFALFA.

Alfalfa is undoubtedly the best legume for permanent meadows in localities where it will succeed, but it does well in only a small part of the cotton region. For its profitable growth it needs a rich, well-drained soil containing an abundance of lime and having an open subsoil. Such soils are found in all the black-prairie region of Alabama and Mississippi, in the alluvial regions along the Tennessee, Mississippi, and Red Rivers, in northeastern Texas, and in the Rio Grande region. Good alfalfa soils are also found on many river and creek bottom lands where the adjacent hills are of limestone. It has not been satisfactory when grown on dry clay uplands; and on sandy soils it may make two or three good cuttings, but usually disappears before the end of its first year. It has not been grown successfully in the pine woods or in Florida and the Gulf coast region, where it may make a good growth in the spring, but is soon smothered out by crab-grass. Soils which are otherwise suited to its growth but are deficient in lime may be made to produce good yields by an application of lime. The application should be liberal, not less than a ton of burnt lime or two tons of ground limestone per acre.

Seeding may be done from August to October or from February to April. Fall seeding is generally to be preferred, as weeds are then less troublesome and a full crop can be obtained the next spring. On the black prairie soils of Alabama and Mississippi spring seeding is the almost universal practice. This is partly because the fall is usually a dry season, partly because weeds give little trouble on these soils, and partly because it is often sown on land which was in cotton the previous season, and so could not be made ready in time for fall planting. A good preparation of the land for seeding is to grow a crop of cowpeas or soy beans during the previous summer. Before planting the cowpeas the ground should be plowed as deep as possible and then harrowed smooth so that there will be no low spots where water will stand and so that a mowing machine can be run over it easily. As soon as the crop of cowpeas or beans is gathered the ground should be disked or plowed very shallow and then harrowed until the surface is fine and mellow, after which the seed is sowed at the rate of 25 to 30 pounds per acre and covered by rolling or light harrowing. Deep plowing just before seeding is never good practice, as it leaves the subsoil in such a loose condition that the plants are more easily thrown out of the ground by winter freezes and suffer more seriously in summer droughts. Heavy seeding, as above indicated, is always preferable in the South. One can not afford to imperil the obtaining of a full stand for the sake of saving a little seed. In many cases the planning of the farm is such that

seeding can not be done in the fall, as when cotton or some other late crop occupies the ground. In fact, some growers prefer to plant on old cotton land because it has been so thoroughly cleaned from crab-grass and other weeds. If such land is to be used it should be plowed deep as early in the fall as the cotton can be picked. If this fall plowing is impracticable the spring preparation should be a disking only, for young alfalfa plants do not bear drought well when the roots do not reach a firm subsoil. Deep plowing should not, as a rule, be done within three months of the time of seeding.

In all cases the soil should be inoculated with alfalfa bacteria. This is best done by the use of soil from an old alfalfa field. Soil from a bur clover or a melilotus field will answer the same purpose. This inoculating soil should be scattered over the new field at the rate of about 200 pounds per acre, just before the seed is sown, and harrowed in immediately. Where inoculated soil can not be obtained the artificial cultures of the bacteria may be used. In this event it is advisable to plant but a small patch of alfalfa, as the cultures are not always successful and one is not warranted in taking the risk on a large field. If the small patch is successful it will furnish an abundance of soil for further inoculation. Land which has grown melilotus or bur clover within two years does not need inoculation. Most alfalfa fields, even those on soils containing considerable lime, are usually improved by an occasional top-dressing of lime.

When sown as early as August, alfalfa in a favorable season will often give a fair cutting for hay in December and may be expected to give three to six cuttings of about 1 ton each the following season, while if sown in the spring one or two cuttings is all that can be expected the following summer. Many planters use it for grazing hogs and find it very profitable. When a field is used for continuous grazing it requires care to keep it in good condition. It should not be overstocked late in summer or it will be seriously injured. In the spring and early summer a good field will carry 20 to 25 hogs per acre, and the animals will make a fine growth, but later in the season the number should be decreased or all removed, so as to give the alfalfa a few weeks of rest.

MELILOTUS.

Melilotus, or Bokhara clover, the "sweet clover" of the North, is a close relative of alfalfa and is an important hay and pasture plant on soils which are rich in lime and are not of sufficient depth or are in too poor a mechanical condition for alfalfa or red clover. It is most abundant in the black prairie region, where it makes a luxuriant growth, even in places where the lime rock is covered with only a few inches of soil. If cut while the plants are young, as soon as

they begin to make flowers, the hay, except for its odor, can hardly be distinguished from alfalfa; and as it will give two or three good cuttings in a season, it is a valuable hay plant. If, however, the plants are allowed to become too old and mature before they are cut, many of the leaves will drop, the stems will be hard and woody, and the hay of poor quality. It is also one of the best pasture plants for dry lime hills, as it begins its growth early in spring and continues in an eatable condition through the entire season. After a field is once seeded it continues to produce two crops each season if undisturbed. In many parts of the country it is regarded as a worthless weed and is not readily grazed by horses or cattle, but it is not so in the South, where it grows on a soil unsuitable for most other grazing plants and where it is eaten nearly as freely as alfalfa or clover. Seed may be sown in September and October or in February and March at the rate of half a bushel of unhulled seed or 20 pounds of hulled seed per acre. Usually but one cutting for hay can be made the first season, but the second season it will commonly give three cuttings of 1 to 2 tons each. The roots are very large and grow deep; and as most of them die and decay at the end of the second year they leave the soil in fine condition for cotton or corn.

RED CLOVER.

Red clover grows best on the alluvial and **black prairie** soils and is seldom profitable when sown on sandy pine-woods soil or on dry clay hills. It requires a moderately rich soil having a fair amount of lime and in good mechanical condition. On sandy soil, even where it makes a good start, it is usually choked out by crab-grass and other weeds before the end of the first season. Even on good soils it rarely lasts more than two or three years, but it yields so heavily and its hay is of such good quality that it is a profitable crop on all soils suited to its growth. Land should be prepared as for alfalfa and the seed sown early in the fall, not later than the middle of September in any part of the cotton region, so that the plants may become well rooted before winter. It will then make a rank spring growth and give a heavy cutting, 2 to 2½ tons in May, a lighter cutting in June, and in favorable seasons another cutting in September, though the last cutting may be very light in seasons of a long summer drought. The following April or May it will give another cutting nearly or quite as heavy as the first, after which the ground should be plowed and used for corn or some other crop, as few of the clover plants will live through the second summer. When sown in the spring the yield will be very light the first year, the first cutting being principally of volunteer grasses and weeds, though one or two fair cuttings of the clover may be made later and

a heavy cutting the following spring, but the total yield from the spring seeding will be much less than from a fall seeding. One bushel of seed should be used for each 5 acres, and in the South it should never be sown with a nurse crop.

ALSIKE CLOVER.

Alsike clover varies greatly with the soil on which it is grown, making its best growth on rather low heavy soils, being quite persistent on dry clay uplands and of little value on sandy soils having a low content of lime. It is a perennial similar to the white clover in its general habit and persistency but having nearly the size and vigor of the red clover, which make it one of the best grazing plants on suitable soils. Its yield of hay is light, but it bears grazing well. Alsike clover is the best of the clovers for mixing with redbud for wet soils and will furnish good grazing long after the grass has stopped growing. It should be sown in August or September at the rate of 10 pounds of seed per acre.

CRIMSON CLOVER.

Crimson clover has attracted great attention in the cotton region for some years, but the position which it will finally hold is still uncertain. It has succeeded better and seemed more at home on the Atlantic coast than elsewhere and has given much better results in North Carolina than in either Georgia or Mississippi. It has also done well in some parts of Louisiana. It is an annual which begins its growth with the autumn rains, often giving good grazing from November to April, when it matures its seed and dies. On favorable soils it reseeds itself, even though the ground be plowed and used for short summer crops like millet. Hay made from it is of fair quality, and a yield of 2 tons per acre is not rare, but as it matures during cool spring weather it is somewhat difficult to cure. It makes excellent grazing during the late fall months after most other grazing becomes dry and scarce. Its principal value, however, is for a green-manure crop, as it can be sown in the fall for plowing under in the spring, while the cowpea, melilotus, and most other green-manure crops are summer growers and should be turned under in the fall.

Crimson clover is at present grown most abundantly on the coastal soils of New Jersey to South Carolina and to a less extent west of the Allegheny Mountains. Experiments show it to be well adapted near the coast still farther south. In Georgia, Alabama, Mississippi, and Louisiana it has not proved so successful, owing perhaps to the prevailing dry falls; but many scattered examples of success are found. Inoculation is of high importance and many failures are doubtless to be attributed to a lack of the proper bacteria. Crimson

clover should be sown in the cotton belt during September and October at the rate of 10 to 15 pounds per acre. It is very desirable to plant it either just before or just after a good rain, as otherwise a poor catch often results. The young plants will stand much shade, and a common practice is to sow the seed in corn or other intertilled crop.

BUR CLOVER.

Bur clover is strictly a winter-growing annual and will succeed on a wide range of soils. While it does not make a hay crop it furnishes a large amount of grazing for cattle, sheep, and hogs at a season when other green feed is scarce. Horses and mules do not eat it well. There are two kinds in cultivation, the spotted (*Medicago arabica*) and the California (*M. denticulata*), the former being the stronger grower and the more desirable. The hulled seed sold by dealers is usually of the California variety, while the spotted bur clover, the one more commonly grown in the cotton region, is usually sold in the bur. As the burs always retain small particles of soil when they are gathered from the ground, no other inoculation is needed when they are used, while the cleaned seed must be inoculated as described for alfalfa. Spotted bur clover is also more hardy than the California, resisting frosts that destroy the latter. Neither should be planted north of Tennessee and North Carolina, and even in these States they are frequently winterkilled.

LESPEDEZA, OR JAPAN CLOVER.

Lespedeza, or Japan clover, is an annual which is now found in nearly all of the cotton region except on the light sandy soils of Florida. It does best on a soil with a fair amount of lime and clayey rather than sandy, but grows on all kinds of soil. On very thin or sandy soils its growth is usually so low and spreading that it can be used only for grazing, while on better soils its growth is more erect, reaching a maximum height of 30 inches and sometimes making a yield of 3 to 4 tons per acre. The hay is fully equal to that from red clover or alfalfa, as the stems are very slender and the principal bulk consists of leaves.

When grown for hay it usually follows oats. The oats are sown in September or October, and in February or March the ground is harrowed and the lespedeza seed sown at the rate of half a bushel per acre. The lespedeza makes little growth until after the oats are harvested but then continues to grow until killed by frost. When wanted for grazing the seed may be sown at any time from December to March. Many planters secure it in their pastures by cutting some of the hay late in the fall and scattering it over the hilltops, whence it soon spreads over the whole field. It makes its growth late in the

season, being of little value before May or June, but bears the summer drought well and continues to improve until killed by frost. It is the most widespread and most valuable self-seeding legume in the entire cotton region.

COWPEAS.

Cowpeas are grown more widely in the cotton region than any other leguminous crop and should have a place on every farm. They vary greatly in habit and time of growth. Some varieties produce long trailing vines, while others are usually erect and bushy in growth; some will ripen in two months from planting while others require four or five months; even the same variety varies greatly when planted on different soils or at different seasons. Cowpeas are inexpensive to grow and make a good growth on all soils except those which are very wet. They are excellent for hay or grazing and are the best summer catch crop for green-manuring and improving soils. Though this crop will make a fair growth on very poor soil it responds quickly to an application of fertilizer, and as a heavy growth of cowpeas is the best possible insurance for a heavy following crop it pays well to use any fertilizer which will produce a more thrifty growth of vines.

Cowpeas may be sown broadcast or in drills 3 to 4 feet apart, the first method requiring more seed and less labor, while the drills permit of one or two cultivations, require less seed, are more easily mowed for hay, and usually give a heavier yield. From 4 to 6 pecks per acre are used in broadcasting and from 2 to 3 pecks for seeding in drills, though even 2 quarts of some varieties are sufficient when carefully dropped by hand. A common and excellent practice is to sow them between the rows of corn just before the last cultivation.

When cowpeas are sown broadcast with a small-growing variety of sorghum, like the Amber, using a bushel of the peas and half a bushel of the sorghum seed per acre, the mixture make fine hay, and when sown in drills with a coarser sorghum, like Orange, makes excellent silage.

Saving the hay in good condition is usually a difficult matter in unfavorable weather, and for that reason the planting should be done at such a time that the crop will mature during the dry weather which usually prevails during September and October. For making the best hay the vines should be cut as soon as the earliest pods become yellow, though the work may be delayed a few days if rain should threaten. When cut at that stage the vines cure much more easily and rapidly than when cut earlier, the total yield is at its heaviest, and though the hay may be not quite so tender it will be eaten readily and will have a higher nutritive value.

A common practice in saving the hay is to start the mower as soon as the dew is off in the morning and run it until noon. As soon as the upper surface of the cut vines is well wilted a tedder is run over the field to turn the vines over and expose them more thoroughly to the sun and air. If the crop is very heavy, this may have to be done twice. When a tedder is not available the work can be done with a pitchfork, but this is slower and more expensive. Vines which have been cut in the morning and turned in the afternoon will usually be dry enough to put into small cocks the following afternoon, and if the weather promises to be favorable they should be left in these cocks two or three days before they are hauled to the barn. If it should rain before the vines are put in cocks, they should not be touched until the surface is well dried and then turned as though freshly cut. If the hay is handled promptly and properly, a light rain does very little harm, even after curing has begun, and a heavy rain may fall on freshly cut vines and do little or no damage. The vines should be handled as little as possible or many of the leaves will drop and be lost. When the weather is fair and settled the freshly cut vines are sometimes rolled into bundles as large as can be handled easily with a pitchfork and allowed to lie in the field until thoroughly dry. This method saves labor and prevents any loss of leaves, but the tangled bundles are hard to dry if they should be wet with rain. When peas are grown with corn and are wanted for hay it is best to cut the vines and stalks together and make into windrows the same day. The cornstalks prevent the vines from packing closely, so that they dry more quickly. Such hay can often be put in the barn safely two days after it is cut. Cowpea hay is often cured by stacking the wilted vines around poles 4 to 6 feet high with two or three crosspieces nailed on each. A still better device consists of four poles 6 feet long joined at the top and held 4 feet apart at the bottom by means of crosspieces on which the vines are piled so as to cover the pyramid. The object of both devices is to permit the air to circulate more freely among the vines and so dry them with very little handling and loss of leaves.

When fed on well-cured cowpea hay containing a fair amount of matured pods, horses and mules will keep in good condition through the winter with no grain feed.

The selection of the variety for planting should be determined by the use to be made of the crop. If a heavy yield of hay is the principal object, a vigorous upright variety, like the Whippoorwill or the Groit, is best. If the crop is to be pastured or left to decay on the ground through the winter, any of the trailing sorts sold as Black, Red Ripper, and Unknown are good. The Blacks are especially esteemed for this purpose, as the seeds do not decay easily. Where

land is infested with wilt or with root knot, only varieties resistant to these diseases, like the Iron and the Brabham, should be used.

SOY BEANS.

Although the soy bean has been grown in this country occasionally for a long time it is only within the last 10 years that it has attracted general attention as a forage crop. It has been found to grow well in all the cotton region, as well as farther north. It is strongly drought resistant and makes a hay similar in quality to that from cowpeas, though usually with a larger proportion of seeds and somewhat more woody stems. There are many varieties which differ greatly in time of growth, some ripening within 90 days from sowing the seeds, while others require the whole season. The Mammoth, a late variety, is now commonly grown in the South. The Ito San is a good early variety and quite commonly grown. A number of recently introduced varieties are becoming popular, among them the Haberlandt, Acme, and Tokyo. For the region near the Gulf coast the Riceland and Barchet varieties have given the best results.

The land should be prepared as for cowpeas and the seed planted in drills at a sufficient distance to permit one or two cultivations. One bushel of seed will plant 2 to 3 acres, the amount depending on the distance between the rows. The planting should be shallow, never more than 2 inches, or many of the seeds will decay. Inoculation with soil from an old soy-bean field is desirable but not usually necessary in the South. Rabbits are exceedingly fond of the young plants and sometimes cause serious injury to the crop when the field is near woods. If wanted for hay the crop should be cut when the upper leaves begin to turn yellow, but if wanted for seed the gathering should be delayed until nearly all the leaves have fallen. The hay is easily cured and is fully as nutritious as that from cowpeas. The yield of seed varies from 10 to 30 bushels per acre. It is not a desirable crop to plant with corn, as it matures too late.

As the seeds of many varieties shatter badly, the gathering for seed should not be delayed longer than is necessary for their ripening, and many more seeds will be saved if the cutting is done early in the morning while the pods are still damp with dew.

VELVET BEANS.

The velvet bean is the most rank-growing annual legume cultivated for forage and is one of the best plants for the production of feed and as a restorative crop in the rotation. It is not as good as the cowpea for making hay, as its growth is so strong and the vines are so long and tangled that it is difficult to cut and cure, though when cut early and well cured the hay is of excellent quality. It makes

an immense amount of fall and winter grazing, produces seed abundantly, and leaves the soil in a fine condition for any following crop. It needs a long season for maturing, about eight months, and is rarely grown north of a line from Savannah, Ga., westward to Austin, Tex. It is most commonly grown on sandy lands east of the Mississippi River and especially in Florida. It is one of the best plants for growing on newly cleared lands, as its growth is so dense that it smothers all grasses, sprouts, and weeds, and "civilizes" new soil better than any other crop.

To secure the best results, the vines must be given some support to keep them up from the ground, or they will not fruit well or make so vigorous a growth. Poles are sometimes used for the purpose, but they are troublesome and expensive, while growing cornstalks serve the purpose fairly well and are much cheaper. Some strong-growing variety of corn, like the Mexican June, is planted at about the same time as the beans, and the stalks give the vines the needed support. Pearl millet is also used for the same purpose and gives a better support than corn, but is less valuable for grain. Some planters top the corn as soon as the ears are fairly mature, asserting that the part of the stalk which is left is not pulled over by the vines as easily as is the taller whole stalk. Others plant three rows of corn and one of beans, maintaining that by that method they get a good crop of both corn and beans. Still others plant the corn in 6-foot rows and when it is about a foot high plant beans in the middles. Planted in this way, the corn makes a fair crop, and the vines have abundant support, though the late planting makes only a light yield of seed. The heaviest yield of both vines and seeds is undoubtedly secured when the beans are planted in the row at the same time as the corn, but with such treatment the yield of corn is usually small and difficult to gather.

When grown alone velvet beans should be planted at about the same time and in the same manner as corn, using 8 to 12 quarts of seed per acre. With a good support for the vines the yield of seed is very heavy, from 30 to 50 and sometimes as much as 75 bushels per acre. The seed is gathered by hand. It costs from 15 to 20 cents to gather a barrel of pods, which will shell about a bushel of beans. Thrashing is somewhat difficult, as the pods are very hard and tough, but at present prices the seed is a profitable crop. When a crop of seed has been gathered the vines and immature seed left make rich grazing, and the fertilizing value of the crop is little reduced.

Grazing usually begins at about the time of the first frost and may be continued through the winter, as both vines and beans remain in an eatable condition. The beans are quite hard when mature and dry, but are eaten readily in the fall and again when they become slightly softened in late winter, so that all are consumed before the

ground is plowed in the spring. Dairy men find that it gives the greatest stimulus to milk production when grazed in the fall, while beef growers value it more highly for winter grazing. Hogs usually find plenty of good feed left by the cattle. While it is undoubtedly the most productive annual legume, it has decided limitations owing to the long season required for its growth.

VETCHES.

Of the 30 or more kinds of vetch which the Department has tested in the cotton region only two, the hairy and the English, Oregon, or common, have come into general use. Both are winter-growing annuals and both reseed the ground so freely that with proper management they perpetuate themselves indefinitely. The hairy vetch is the stronger growing of the two and produces the heavier yield of both hay and grazing but makes only a scattering growth on land which was not plowed during the previous summer, while the common variety makes a fair growth on moist rich meadows which may not have been plowed for some years. Both need a soil containing a fair amount of lime.

The hairy vetch does well in all the black prairie and alluvial regions, where it is usually grown with winter oats or rye. Seed is sown in September or October, using a bushel of the oats and from a peck to half a bushel of the vetch. In favorable seasons the crop will give good grazing from December to March, after which the stock should be taken off to give the vetch a chance to mature seed. When the vetch seed begins to ripen, about May, the mixture will yield about a ton per acre of hay which is of the very finest quality, and enough of the vetch seed will be scattered on the ground to reseed the field for the following season. During the summer the ground may be used for corn, millet, or any other short-season crop, and if plowed and reseeded with oats in September will make a better yield than in the previous season. On lands set in Johnson grass some growers plow after the last cutting in September and seed with vetch and oats. This gives good winter grazing, a crop of mixed vetch and oat hay in April or May, and two heavy cuttings of Johnson grass during the summer, after which the ground is again plowed and seeded with oats only, as the vetch does not need reseeded.

The common vetch needs about the same treatment, is much more persistent on meadows which have not been plowed recently, and is the better kind for pasture lands. Both grow much more vigorously and seed much more freely when grown with oats or some other crop which gives the vines at least a partial support, as they make a poor growth and do not seed well when lying flat on the ground. The

mixture gives the best winter grazing that has been found for cattle and hogs but is less valuable for horses and mules.

Some of the native vetches, especially the Louisiana and the Narrow-leaved, are found in many meadows and are highly valuable, but their yield is so much less that their cultivation is much less profitable.

When planted for the first time it is necessary to inoculate the land by using soil from an old vetch field or by the use of cultures if soil is not procurable.

FLORIDA BEGGARWEED.

This is an important forage plant from central Florida northward to southern Georgia and Alabama, and occasionally farther north, being most common as a volunteer growth in old fields having a light sandy soil. It is an annual which makes its growth late in the season at the same time that crab-grass is growing most rapidly, the two usually being found together. It is erect in growth, reaching a height of 5 to 7 feet on good soils and is used for hay, silage, and grazing. When cut at the right time and properly cured it makes superior hay, but it must be handled carefully. If allowed to become too old before it is cut many of the lower leaves are lost and the stems become woody. After cutting it should be windrowed as soon as wilted to prevent the leaves from dropping. If run through a shredder the stems are eaten readily, even when quite mature. To make good hay it should be cut when not more than 3 or 4 feet high, usually in July, and a second cutting can then be made a few weeks later. Although not sufficiently bulky for use in filling a silo, a little of it mixed with other material adds greatly to the value of the silage, as it gives a marked "June" flavor to butter even when used in midwinter. Its greatest value, however, is as a grazing plant in late summer and early winter, as it is even more fattening than alfalfa or cowpeas.

It usually makes a scattering and uneven volunteer growth on land which has not been plowed during the year, though when occasional strips are left standing at the second cutting and the field is then harrowed crosswise to scatter the seeds a good crop is secured the second season after plowing. The better practice is to reseed the ground after oats, melons, or some other early crop has been removed, using 20 to 30 pounds of the rough seed per acre. The seed is usually saved by stripping it from the plants by hand, the labor making it cost about 3 cents per pound. Clean hulled seed is now handled by seedsmen.

In the region where it is grown most commonly it is seldom seen as a volunteer crop on newly cleared lands, but is more or less abundant, growing with crab-grass and Mexican clover in nearly all old fields, especially in corn and cotton, where it springs up after the crops are

laid by and furnishes a large amount of good grazing after the crops have been gathered. Some cotton growers object to it in their fields, as the immature seeds are somewhat rough and the stalks when switched about by the wind often pull seed cotton from the bolls.

It is easily killed by a single cultivation in late summer and soon disappears from fields which are not plowed. While it is a crop of secondary importance and seldom used alone, it is a welcome addition to any hay crop, and when so abundant as to afford good grazing it will fatten horses, mules, and cattle more rapidly than most other plants.

PEANUTS.

Peanuts are often profitable both for hay and for grazing, the Spanish variety being best suited to these purposes. The crop does best on light sandy soil, which must contain a good supply of lime or many of the pods will fail to fill. Any sandy soil may be made to produce good yields by the application of 50 bushels of ground limestone per acre, broadcast, just before the ground is plowed. The planting requires about 2 bushels of seed per acre, and in the northern part of the cotton region these should be carefully shelled before planting, though that is not necessary in the southern section. The crop requires no special cultivation except to keep it free from weeds and to keep the surface so mellow that the shoots can bury themselves easily. If the crop is to be used for hay, it should be gathered just before the first frost. When vines of the Spanish variety are pulled nearly all of the nuts will adhere to the stems and after drying will make a hay even richer in protein than that from cowpeas or soy beans. Hogs eat both the vines and the nuts, and the crop should not be grazed before the nuts begin to mature. Hogs pastured on peanuts are fattened very cheaply, but the pork is more oily than that from corn-fed animals. In the Atlantic coast region peanuts are often planted with corn, after the manner of planting cowpeas and soy beans.

MISCELLANEOUS FORAGE CROPS.

While grasses and legumes furnish by far the most important forages, other plants, especially those with tuberous roots or very succulent foliage, are often useful and desirable. Among such grown in the Southern States are Mexican clover, Jerusalem artichokes, chufas, sweet potatoes, cassava, and rape.

MEXICAN CLOVER.

Mexican clover, sometimes called "pusley" or "purslane," though entirely different from the plant known by those names in the North, is not a true clover, but belongs to the same family as the madder,

poverty weed, and a number of other common plants. It is an annual of much the same habit of growth and size as common red clover, but the leaves are opposite and simple instead of alternate with three leaflets. It grows most abundantly in cultivated fields from which early crops have been removed, but often makes a heavy growth in corn and cotton after those crops have been laid by. It is seldom planted, as, like crab-grass and beggarweed, it makes a volunteer growth late in the season. It is doubtful if the yield would be increased materially if it were sown early and the ground given up to it through the whole summer. It is common in old fields near the coast from Florida westward to Mississippi. It makes a fair growth on soils too poor for most other crops and may be used both for hay and for grazing. While the hay is not of the best quality, it is eaten readily by most animals, and as it is usually more or less mixed with crab-grass and beggarweed it adds largely to the bulk and value of an inexpensive crop. When used for grazing it is more valuable for hogs than for other stock, though eaten well by mules and cattle. It can be grazed from about June until after heavy frosts and will then reseed the ground abundantly.

The seeds are very small and difficult to save, though they are sometimes beaten out with flails or gathered from the bottom of a mow in which the hay has been stored. From 4 to 5 pounds per acre are sufficient for seeding, but the common method of distributing the plant is by mowing after some of the seed is matured and scattering the hay over the field on which the crop is wanted the following season. A planter in northern Florida who has grown beggarweed 15 years reports that he has kept 4 horses and 20 hogs in good condition 8 months on a field of 7 acres. The field had been in oats the previous season and the growth was somewhat mixed with crab-grass and beggarweed, but was mostly Mexican clover. A southern Mississippi grower states that it doubles the yield of his volunteer hay crop and that the mixture is worth fully as much as any hay he can buy.

While it is not a nitrogen-gathering plant like the true clovers, its growth is usually volunteer and so costs nothing, but it protects the surface of the ground from the scorching sun in summer and washing rains in winter and adds to the fertility of the soil by furnishing humus. The plant should be regarded as an inexpensive substitute for something better rather than as one to be carefully planted and cultivated.

CHUFAS.

Chufas are a profitable crop on sandy soils where winter grazing is wanted for hogs and poultry. They grow best on soils which are very light and sandy and yield well with a moderate amount of culti-

vation. They involve no expense for gathering and storing, except for the small amount of seed tubers which may be wanted for the following season. Chufas should be planted in early spring about a foot apart in rows 3 feet apart, or as close as they can be cultivated conveniently, using about half a bushel of seed per acre. No special care is required, except to keep the ground free from weeds. They can be used from September to January. Many growers claim that the tubers are more fattening than peanuts.

RAPE.

Rape is a valuable grazing plant during the cooler months, especially for hogs. It makes a rank growth, renews itself quickly after being grazed off, and bears heavy frosts with little injury. When sown in August or September it will be ready for grazing in about six weeks from seeding, and later sowings will furnish feed until late spring, while March or April seedings will give grazing for early summer. It is commonly sown broadcast, using 6 to 8 pounds of seed per acre, while if sown in drills 3 to 5 pounds are sufficient.

SWEET POTATOES.

Sweet potatoes are very easily grown and make heavy yields in all the pine-woods regions and in other sections having sandy soils. In the southern part of the cotton region they can be planted at any time from March until July, and so can be had ready for use from August until midwinter, though those planted early in the season do not yield as heavily or keep as well as those which are planted later. They are used quite extensively for grazing hogs, and as they make from 4 to 6 tons of tubers per acre and cost nothing for gathering they are an inexpensive feed for fall fattening. The vines make hay of fair quality, and in some sections they are thus utilized.

JERUSALEM ARTICHOKEs.

Artichokes make a valuable grazing crop for hogs in the northern and central parts of the cotton region, but yield less heavily and are less desirable farther south. They require the same soil, methods of planting, and cultivation as Irish potatoes, but yield much more heavily and are worth fully as much for feed. They are strictly a winter feed, not being well matured until December. From that time on until March they furnish perhaps the least expensive roots grown for hog feed. No special cultivation is needed, except to keep down weeds. When the crop is matured, enough of the tubers for planting the next season should be plowed out and buried like potatoes, after which the hogs may be turned into the field. Though the hogs will leave a few of the tubers in the ground, it is not well to depend on them for a crop the following year, even when they are to be grown

on the same ground. Such scattered tubers may make a fair stand, but they will be so irregular that the ground can not be cultivated and the yield will be small. It pays much better to plow the ground and to plant in regular rows.

Even with the most careful digging a few tubers will be missed, and these will make a volunteer growth the following season. Many farmers object to them on that account, but if the volunteer plants are plowed out or hoed off in midsummer after the old tubers have become exhausted and before the new ones have formed there will be no further growth. While artichokes alone are a poor ration for either growing or fattening hogs, 3 bushels of them fed with 1 bushel of corn are fully equal to 2 bushels of corn, and the fresh feed which they give keeps the animals in much better health than when fed on corn alone.

CASSAVA.

Cassava is grown to a considerable extent in central and southern Florida and occasionally along the Gulf coast westward to southern Texas. It does best on light sandy soils, on which it yields 5 to 10 tons of roots per acre. The roots are similar in appearance to those of sweet potatoes, but are much larger and make an excellent feed for cattle and hogs. Cassava is propagated by sections of the old stems, which are cut into pieces 4 to 6 inches long and planted about 4 feet apart each way, the after cultivation being the same as that given to corn. Cassava should be planted about the same time as cotton, the crop maturing from October to November. The roots will remain in the ground all winter in good condition, but as they decay in a few days after exposure to the air they should not be dug until wanted. The stems which are used for planting are killed by moderate frosts and are somewhat difficult to preserve in good condition through the winter, except in the extreme south. The best method of preserving them where heavy frosts occur is to cut them when well matured and bury them in a dry place where they will not become frozen.

HAY CROPS.

A good hay plant should make a large growth, be leafy, have fine and tender stems, be palatable, and erect enough so that it can be cut readily with a machine. If the meadow is to be permanent the plants should be perennials, while if temporary, annual plants are usually more profitable. If the hay is to be used exclusively for milch cows, fattening stock, or for young and growing animals, the plant should be a legume, but the true grasses make a hay which is more satisfactory for livery horses and other animals doing hard work. If the hay is to be sold, of course the choice of kind will depend on the demands of the market to be supplied. It is often the case that hay

can be made which is so palatable and nutritious as to be highly valuable on the farm, but so coarse and unattractive in appearance as to be almost unsalable on the market. Such hay should be valued by its feeding rather than by its market value. Cowpea hay mixed with cornstalks, cockleburrs, and ragweed may have little sale value, but it will keep mules in fine condition through the winter without the addition of any grain. For ordinary farm use hay made from a mixture of both legumes and grasses is more desirable for general feeding than hay made from either alone.

PREPARATION FOR PERMANENT MEADOWS.

In the cotton region, where a crop of good hay can be grown in almost any three summer months, when the fields are not in use for other purposes, annual and catch crops furnish a large part of the hay, and permanent meadows are less important and less common than farther north, though they are profitable in many localities. The most productive meadows are usually those which contain at least two kinds of plants, one of them a legume which makes its best growth early in the season and the other a grass which gives its heaviest yield in the summer and fall. After a field has been used for such crops two or three seasons the yield of hay is so decreased that it is usually better economy to plow and harrow or disk the field in the fall, after the last cutting for hay, which will leave it in the best possible condition for cotton or grain the following spring.

A permanent meadow requires a rich soil, thorough preparation of the ground, and constant care. Before it is planted the surface should be made smooth and even, so that there will be no ridges or ditches to interfere with the use of the mowing machine or the rake, and all low spots should be filled in or drained so that water can not stand to kill the grass. None of this work can be done after planting without serious injury to the stand. If the soil is not rich it should be made so by the use of stable manure or by the plowing under of a crop of cowpeas. Such fertilizing is usually much more effective than the use of commercial fertilizers, which furnish no humus, one of the greatest needs for the production of heavy yields of grass. If the land is too poor and thin to make a good yield of cowpeas it is too poor for a meadow, and if it can be made to produce a good yield of pea vines the success of the following hay crop is practically assured.

The profitable life of a meadow depends largely on the kinds of plants used, the character of the soil, and its treatment, the treatment being, perhaps, the most important factor. Where the growing season is nearly continuous the roots of any perennial hay plant soon become so numerous and densely matted than an occasional plowing and harrowing of a crop like Bermuda or Johnson grass is

highly beneficial and the disking of a crop like alfalfa will stimulate a more vigorous growth. No meadow can continue to make heavy yields without the use of fertilizers, which should be highly nitrogenous for the true grasses and rich in phosphoric acid and lime for the legumes. A winter top-dressing with stable manure is the best fertilizer for any meadow, but it is not often available in the cotton region. Such manure should be applied after the last cutting in the fall and disked or leveled with a heavy harrow early in the spring. It makes little difference whether the disking precedes or follows the application of commercial fertilizers.

VARIETIES FOR PERMANENT MEADOWS.

The best grasses and legumes for permanent meadows vary widely in different parts of the cotton region. In the northern section timothy does well in some localities, but can not be depended upon farther south than Tennessee and the Carolinas. In the greater part of the cotton region Bermuda and Johnson grass in limited areas are the more important plants for permanent meadows. The seeding with legumes, alfalfa, clover, etc., and with the perennial grasses should be done early in the fall, if possible, so that the young plants may have time to become well established before cold weather and ready to begin a vigorous growth with the first warm days of spring. No nurse crop should be used, as the early growth of the hay crop will need all the space before the nurse crop is ready for harvesting, nor should any permanent meadow be pastured during the first winter. Alfalfa and red clover make their best growth on land which is well adapted to Johnson grass and usually more or less thickly set with it, and the mixture makes a meadow which is very productive of hay of fine quality. In fact, most feeders prefer this mixed hay.

If Johnson grass is already growing on the land where the meadow is to be established no further attention need be given it, the clover or alfalfa being seeded in the fall. Such meadows give two to four cuttings annually, the earlier cuttings being largely of alfalfa or clover, while the later cuttings will contain a larger proportion of Johnson grass. In the black prairie region and on the heavy black lands of Texas, Johnson grass alone is used largely in permanent meadows, usually giving three annual cuttings. It is important that this grass should be cut as soon as it begins to head, both because it makes a finer and better hay at that time and because it then has no seed sufficiently mature to scatter the grass into fields in which the manure may be used. All Johnson-grass meadows need an occasional plowing to break up the hard surface and to prevent the roots from becoming so matted that growth is weakened. Many growers take advantage of that fact to grow other crops on

the same ground. The grass is plowed in September or October after the last cutting and is then seeded with winter oats and vetch, usually for hay. After this is harvested two or three cuttings of the Johnson grass are made before the land is again plowed and seeded the following September.

For rich river and creek bottom lands Bermuda is one of the best hay grasses, as on such soils it makes a heavy yield, 4 to 6 tons per acre in three cuttings. As it starts rather slowly it is better to plant some other crop on the ground at the same time the Bermuda grass is planted. If the ground is seeded with vetch, either the smooth or the hairy, the yield of the first cutting the following spring will be greatly increased and the quality of the hay greatly improved. When planted late in summer a quick growth can be secured by sowing Italian rye-grass at the rate of 20 pounds per acre and covering it by light harrowing. The rye-grass will cover the ground in a few weeks, make excellent grazing or a moderate yield of hay the following spring, and then gradually disappear as the Bermuda occupies the ground. This use of the rye-grass is specially desirable in the making of lawns and in securing an immediate growth of grass about the house. Bermuda grass forms such a dense mat over the surface and yields so heavily that the meadows need an occasional fertilizing and breaking up to keep them in the best condition. For such fertilizing well-rotted stable manure is the best thing which can be used; spread it evenly in the fall and then go over the field early in the spring with a disk harrow set at such an angle that it will cut the matted sod but will not tear it up enough to leave the surface rough. If stable manure is not available cottonseed meal should be used, applying it immediately after the disking. *Paspalum* grass is a valuable constituent of permanent meadows in certain localities, especially in the northern part of the cotton region, but on account of the high price of the seed it is seldom sown.

TEMPORARY MEADOWS.

Temporary meadows, of short-season annuals grown for hay, are of much greater importance in the cotton region where crops may be grown through the entire year than they are in sections where the growing season lasts only six to eight months and where the growing of such crops would interfere with the other regular crops on the farm. Both summer and winter crops can be used in this way. Not only can they be grown without interference to other crops, but they can also be made highly beneficial to the land by protecting it from washing rains and the scorching sun, and if legumes are used, by adding nitrogen to the soil.

Among the summer crops which can be grown for hay, cowpeas, lespedeza, beggarweed, Mexican clover, crab-grass, the millets, and

the sorghums are the more important. Of these all except sorghum may be grown during the last three months of warm weather, and on land which has been used for some other crop earlier in the season. Crab-grass, beggarweed, and Mexican clover are usually volunteer crops, and while their yield is not often heavy, commonly not more than about 1 ton per acre, they are made with no expense except for the harvesting, and so are very profitable. Cowpeas make a hay worth fully as much as red-clover hay, and it is generally believed that the expense of growing the crop is fully made up by its fertilizing effect on the soil. Their fertilizing value is so well recognized that many planters furnish the seed and the use of land free to their tenants for the increase which it gives to the following crop. A large amount of cowpea hay is made by planting the cowpeas in the cornfields at the time of the last cultivation and then mowing both the stalks and vines after the corn has been gathered. Such hay looks rough and coarse, but is rich and nutritious.

Lespedeza is an important hay crop in many parts of Louisiana, Mississippi, and Alabama, and there is no apparent reason why it should not be equally profitable in other parts of the Gulf States having heavy lime soils. When grown for hay it is usually sown on oat land early in the spring and will then make a yield of 2 to 3 tons per acre after the oat crop has been harvested.

When it is desirable to secure a crop of hay in the shortest possible time one of the millets should be used, as they are ready to cut in 40 to 50 days after seeding.

Winter-growing annuals are used mostly for grazing but often make profitable hay crops. Among the best of them for hay are the vetches, crimson clover, oats, and wheat, all of which can be sown after the corn has been harvested, and cut for hay in time for planting corn the following spring. Cotton occupies the ground so late in the fall and must be planted so early in the spring that hay can not be grown profitably on the same ground, though good grazing is often secured. The best hay which can be grown during the winter is a mixture of oats or wheat and hairy vetch, and when on a suitable soil the yield is from $1\frac{1}{2}$ to 2 tons of dry hay per acre. While each of these three crops is often grown alone for hay the yield is much greater and the hay much better in quality when vetch is grown with the grain. While it is easily possible to secure good yields of hay grown during the winter the practice of growing it at that season is not likely to become general, since the crop matures at a season when it cures slowly and when the farmer is usually crowded with other work.

PASTURES.

Much of what has been said in relation to the formation of meadows applies equally well to the formation of pastures, except that in a field designed for a permanent pasture a much greater variety of plants is desirable. Bermuda and carpet grass are the foundation of all good permanent pastures in the cotton region, the Bermuda being the best on all heavy soils, while carpet grass takes its place on light sandy soils. One or both of these, together with any others that promise success, should be planted in every pasture. In the South the best pastures should give good grazing eight or nine months every year and some grazing the other three or four months. While Bermuda and carpet grass are the best for general use, both start slowly, and when first planted should be supplemented with some of the rye-grasses for a quick winter growth, orchard grass for woods pastures, redtop for wet ground, and *Paspalum dilatatum* for heavy clays. Every permanent pasture should have a good proportion of legumes, and the best of these are lespedeza, melilotus, bur clover, common vetch, white clover, and alsike clover. Lespedeza is best for the dry clay hills, melilotus for lands rich in lime, while bur clover and the vetches are the best addition to Bermuda sod. White clover comes in naturally in every pasture and alsike clover should be sown on all wet or heavy soils.

Wild lands will furnish a certain amount of grazing and even when they can not be plowed their natural condition can often be greatly improved by going over them with a heavy harrow or a disk and then seeding with such kinds as are suited to the soil. To make a good pasture on land which has never been cultivated is a very slow process. Wherever it can be done it will pay to plow and harrow the ground, even where trees and stumps are so numerous that not more than half the surface can be disturbed. A very good pasture requires as good soil, as much work in its preparation, and as careful handling as any field on the farm. After the ground has been plowed or disked and the seed sown no grazing should be allowed until the young plants become so firmly rooted that they will not be pulled out by the grazing animals. When seeding is done in the fall the field should never be grazed until the spring growth is well started, and no permanent pasture should ever be grazed so heavily as to injure the stand.

PASTURE WEEDS.

There are two weeds which sometimes make serious trouble in permanent pastures, the bitterweed and the garlic or wild onion. The presence of bitterweed is always an indication that the pasture has been grazed too closely or has been trampled so heavily as to make the surface soil too hard and compact for grasses and clovers to

grow. The weed is never troublesome on a rich soil in good condition and rarely so on a poor soil which is not too closely grazed. It may be easily eradicated either by the use of fertilizers or by decreasing the number of grazing animals. The destruction of the wild onion is a more difficult matter. It can be killed by a very deep plowing of the ground in September or October, followed by a very shallow plowing in the spring and then planting the field with some cultivated crop. However, this method can not be followed in an ordinary pasture where there are many trees or in any pasture without destroying the grass and so making the field useless as a pasture for about 18 months. When a pasture is not infested it should be watched closely and any wild onions which make their appearance removed at once.

TEMPORARY PASTURES.

Temporary pastures for summer use require less attention to planting than to fencing, as nearly every field will give a few weeks of good grazing in the intervals between the regular crops and when properly fenced will give all the summer grazing needed on farms where cotton and grains are the principal crops. Winter pastures need special preparation and care and are practically limited to the growing of small grains and vetches for horses and cattle, with the addition of artichokes, chufas, sweet potatoes, and cassava for hogs. Oats or wheat and vetch make the very best grazing from December to April, and the best pasture for dairy cows. At the Mississippi experiment station a mixture of turf oats and hairy vetch has been in use many years, the seeding being done in September and the fields ready for grazing in December, when the growth is usually sufficient to support three cows per acre, which number can be largely increased as the season advances. Horses and mules do not eat the vetch greedily, but the oats or wheat gives them good grazing from January to April, when the permanent pastures begin to give abundant feed. One bushel of turf oats or wheat and 1 peck of vetch seed are sufficient for sowing an acre, while if the Rustproof oat is used the amount should be increased about one-half.

It is sometimes difficult to secure constant fresh grazing in the northern part of the cotton region in unfavorable seasons, but in the central and southern parts it is quite possible to have fresh pastures, especially for cattle and hogs, during the entire year. Among the crops which can be used for this purpose are the following:

January and February: Wheat, oats and vetch, artichokes, rape, bur clover, velvet beans.

March: Oats and vetch, artichokes, rape, bur clover, crimson clover.

April: Oats and vetch, rape, bur clover, alfalfa, crimson clover.

May: Oats and vetch, rape, red clover, alfalfa, crimson clover.

June and July: Sorghum, cowpeas, red clover, alfalfa.

August: Sorghum, cowpeas, soy beans, alfalfa.

September and October: Sorghum, cowpeas, soy beans, chufas, sweet potatoes, corn, peanuts.

November: Cowpeas, soy beans, chufas, sweet potatoes, corn, rape, peanuts.

December: Cowpeas, chufas, sweet potatoes, corn, rape, velvet beans.

It is not to be expected that all of these will do well on any one plantation, but a selection can be made from the list which will fit nearly every condition on every farm.

SILAGE CROPS.

While the silo is of less importance in the cotton region than in regions of shorter grazing seasons, it is usually a profitable investment for the dairyman. It provides supplies of succulent feed through the dry weather which is almost sure to occur in late summer, as well as in the winter when the pastures are too scant or too wet for grazing. Corn and sorghum are the principal crops for making silage, but the quality of the feed made from them is greatly improved when mixed with even a small proportion of some legume, like cowpeas, soy beans, or beggarweed. Cowpeas are usually the most satisfactory plants which can be used for this, as they can be grown with the corn, and as the vines become tangled with the cornstalks they are readily handled in running them through the silage cutter. A mixture of beggarweed and cowpeas or soy beans is often used in the sandy coast region, the beggarweed stems making the pea vines much easier to handle and being of the highest value for giving a "June" flavor to winter butter. It is seldom possible to have enough of this mixture to fill the silo, but if as much as one-tenth the bulk be of this and the remainder of corn the whole contents of the silo will be flavored. For the bulk of the silage, corn is better than sorghum, as it contains more nutriment and the stalks are not so hard. The largest growing varieties should be used and should be planted much more thickly than for grain. The crop should be siloed when the kernels begin to glaze and before the lower leaves become dry. Sorghum is often used for silage and has the advantage of remaining green and in good condition much later in the season, and so is often desirable on account of lengthening the time during which the silo may be filled. The cost of making silage depends largely on local conditions, but \$2 per ton is about a fair average.

SOILING CROPS.

Soiling is often more economical than grazing, especially where land is expensive, as it enables one to keep fully three times the number of animals on the same area. Its principal use is for the dairy. While the character of the feed is practically the same as that from temporary pastures it is used much more economically, being gathered only as needed and without injury to the roots, so that the plants make a second growth much more quickly and vigorously than when grazed and trampled. One successful dairyman near Harmony, Ga., reports that he keeps an average of 5 cows per acre with his soiling crops, while another near Atlanta states that he kept 25 cows in good condition from the middle of June until the last of September by the use of Amber sorghum grown on $2\frac{1}{2}$ acres.

A profitable soiling crop requires a rich soil in good condition and the field should be near the feeding lot to save labor in hauling. The most productive soiling crops for general use are oats, vetch, and alfalfa for March, April, and May; alfalfa and Johnson grass for May and June; with alfalfa and sorghum from June to October. Of course the choice must depend largely on the location and soil of the particular field on which the crop is to be grown. On soils where alfalfa can not be grown it is usually possible to use vetches, cowpeas, or soy beans in its place. On very rich soil in the extreme South teosinte makes a heavier yield than any other forage crop. Many prefer rye or wheat to oats for an early crop, while rice is valued highly in sections where it can be grown. Guinea grass gives frequent and heavy cuttings along the Gulf coast and in Florida, and German millet is ready for use in about 40 days from planting. It is usually better to make successive plantings of annual soiling crops so that all the crop from each planting can be used just as it reaches its best condition and before it becomes so mature and dry as to lose its succulency. Soiling crops are always profitable when a large amount of fresh feed is wanted from a limited area of ground, but less so when good summer pastures are available.

MAKING HAY.

The best time for cutting hay varies almost as much as the methods of curing. Most grasses should be cut as soon as they are well headed, though the millets and Johnson grass should be cut as soon as the heads begin to show from the boot, while the winter grains should stand until the seed is in the milk stage. Legumes like cowpeas and soy beans in which the seed is an important part of the forage should not be cut until the earliest pods begin to mature; while perennial legumes like alfalfa and the clovers should be cut as soon as they begin to blossom.

It is impossible to give definite rules for the making and curing of hay, as the processes must vary with the kinds of plants from which the hay is made, with the yield, and with the climate. There are, however, a few general principles which should always be observed.

The best hay made from any crop is always that which is made the most quickly and with the least exposure to sun and air. Too much exposure to the sun bleaches the hay, making it less attractive when placed on the market, and also makes it less palatable and less digestible. Nearly all kinds of hay should be at least put in the windrow the day after they are cut, and many of the finer and lighter grasses like Bermuda and redtop should be put in the shock. Even slow-drying hays, like cowpeas and alfalfa, should be raked into windrows as soon as well wilted to avoid the loss of leaves when handled too dry and can be put in shocks by the second day. After it has become half dried, hay will cure perfectly even when in shocks of considerable size and is much safer there than on the ground. As soon as the shocks are well cured and even before they become bone-dry in the middle they should be hauled to the barn or stack to avoid damage from rain. The bleaching on the outside of the shocks injures the hay, and the sooner it is put into the barn after being cut the better will be its quality.

RECOMMENDATIONS BY AGRICULTURISTS OF SOUTHERN EXPERIMENT STATIONS.

Owing to the great number of forage crops adapted to the cotton region there is room for considerable difference of opinion as to the best to use for any given locality. In Table I are given the recommendations of the experts at each southern experiment station. These were communicated on request by Director C. B. Williams, of North Carolina; Director J. N. Harper, of South Carolina; Director P. H. Rolfs, of Florida; Director J. F. Duggar, of Alabama; Director E. R. Lloyd, of Mississippi; Director W. R. Dodson, of Louisiana; Prof. Martin Nelson, of Arkansas; and Mr. A. B. Conner, of Texas. Corn is intentionally omitted from this table, except as to Florida, because it is considered primarily a grain crop, though also furnishing much forage and often grown for forage alone.

TABLE I.—*The best forage crops for the Southern States.*

Character of crop.	North Carolina. (Williams.)	South Carolina. (Harper.)	Alabama. (Duggar.)	Mississippi. (Lloyd.)
Annual winter crops for hay.	Oats. Oats and vetch. Crimson clover.	Oats. Hairy vetch. Rye. Wheat.	Oats. Hairy vetch.	Oats. Hairy vetch. Crimson clover.
Annual summer crops for hay.	Cowpeas. Soy beans. Sorghums.	Cowpeas. Sorghums. Soy beans. German millet. Sweet-potato vines.	Cowpeas. Sorghum. Lespedeza. Soy beans.	Cowpeas. Lespedeza. Peanuts. Sorghums. Soy beans.
Annual winter crops for pasture.	Oats. Oats and vetch. Crimson clover. Italian rye-grass. Rye. Canada field peas and oats. Rye and crimson clover. Bur clover. Rape.	Barley and vetch. Oats and vetch. Wheat and vetch. Rye and vetch. Crimson clover. Bur clover. Italian rye-grass.	Bur clover. Oats and vetch. Rescue grass. Rye.	Oats. Barley. Rye. Bur clover. Rescue grass. Hairy and common vetch.
Annual summer crops for pasture.	Cowpeas. Lespedeza. Soy beans.	Cowpeas. Soy beans. Peanuts. Chufas. Lespedeza. White clover.	Lespedeza. Soy beans. Peanuts. Cowpeas.	Cowpeas. Lespedeza. Soy beans. Peanuts. Sorghum.
Permanent hay meadows.	Redtop, orchard grass, alsike clover, mammoth clover, and timothy (mixed).	Johnson grass, Bermuda grass, redtop (herd's-grass), orchard grass, perennial rye-grass, paspalum, and lespedeza (mixed).	Alfalfa. Johnson grass. Melilotus. Bermuda grass and lespedeza.	Bermuda grass. Johnson grass. Lespedeza. Alfalfa. Melilotus. Red clover.
Best permanent pastures.	Bermuda grass and lespedeza for uplands in coastal plain. Redtop, perennial rye, tall meadow oat, and alsike clover for lowlands in coastal plain. Orchard grass, redtop, bluegrass, and red clover for piedmont and mountain uplands.	Bermuda grass, lespedeza, white clover, and paspalum (mixed).	Bermuda grass and bur or white clover (mixed). Johnson grass and bur clover (mixed). Lespedeza. Orchard grass should be added on good uplands and redtop on moist lowlands.	Bermuda grass, lespedeza, bur clover, whiteclover, alsike clover, Johnson grass, redtop, orchard grass, and melilotus (mixed).

TABLE I.—*The best forage crops for the Southern States—Continued.*

Character of crop.	Louisiana. (Dodson).	Eastern Texas. (Conner.)	Arkansas. (Nelson.)	Florida. (Rolfs.)
Annual winter crops for hay.	Oats. Hairy vetch. Red clover. Crimson clover.	Oats. Hairy vetch.	Rye. Oats. Hairy vetch.	Oats.
Annual summer crops for hay.	Cowpeas. Lespedeza. Peanuts. Soy beans.	Cowpeas. Sorghums. Peanuts.	Cowpeas. Sorghums. Soy beans. Lespedeza.	Japanese sugar cane. Cowpeas. Beggarweed. Sorghum. Mexican clover (northern and western Florida). Crab-grass. Corn. Millet.
Annual winter crops for pasture.	Oats. Rye. Rescue grass.	Oats. Bur clover. Rescue grass.	Rye. Bur clover. Crimson clover.	Japanese sugar cane. Velvet beans. Rape. Oats. Rye.
Annual summer crops for pasture.	Lespedeza. Cowpeas. Peanuts.	Cowpeas. Lespedeza. Peanuts.	Cowpeas. Lespedeza. Peanuts.	Sorghum. Corn. Peanuts. Crab-grass.
Permanent hay meadows.	Bermuda grass and lespedeza (mixed). Alfalfa. Johnson grass. Carpet grass.	Bermuda grass and lespedeza. Alfalfa. Johnson grass.	Orchard grass, tall meadow oat, alsike clover, and redtop. Timothy and red clover. Alfalfa. Johnson grass.	Crab-grass. Rhodes-grass. Para grass. Natal grass (central and southern Florida).
Best permanent pastures.	Bermuda grass, carpet grass, lespe- deza, bur clover, and white clover (mixed).	Bermuda grass, les- pedeza, bur clover, and white clover (mixed). Johnson grass and bur clover (mixed).	Bermuda grass, les- pedeza, white clover, and bur clover. Redtop, orchard grass, and alsike clover.	Bermuda grass. Paspalum. Para grass (central and southern Florida).